

THIRD SEMESTER B.Arch. DEGREE EXAMINATION, MAY / JUNE 2005**STRUCTURAL MECHANICS-II****(2003 Scheme)****Time : Three Hours****Maximum : 100 Marks***Any data not given may be assumed suitably.***I. Answer any five of the following :-**

- (a) State and explain the theory of simple bending.
- (b) Define section modulus and derive an expression for section modulus of a rectangular section.
- (c) Define torsion and explain the concept of twisting of beams.
- (d) Define slope and deflection.
- (e) Derive equation for the deflection of a cantilever of length L , moment of inertia I and Young's modulus of elasticity E when loaded with a concentrated load W at the free end.
- (f) Sketch and explain different types of columns based on end conditions.
- (g) Distinguish between long column and short column.
- (h) State and explain Rankine's formula for long columns.

(5 × 5 = 25 marks)

2. a) A beam of symmetrical section is 35cm deep and has a moment of inertia of 13160 cm^4 about its principal axis. To what radius may it be bent if the maximum skin stress is not to exceed 126 N/mm^2 ? Take $E=2 \times 10^5 \text{ N/mm}^2$. What would be the moment of resistance at this stress ? Derive the formula used.

Or

- b) A rolled steel joist of I-section 300mm deep × 150mm wide has flanges 9.4mm thick and web 6.7mm thick. If the permissible skin stress is limited to 120 N/mm^2 , find the safe uniformly distributed load that this section will carry over a span of 5m.

(15 marks)

3. a) A $7.5 \text{ cm} \times 5 \text{ cm}$ rolled steel joist is freely supported over an effective span of 3m. The flanges are 0.5cm thick while the web is 0.37cm thick. Calculate the uniformly distributed load the joist can carry if the maximum intensity of shear stress induced is limited to 40 N/mm^2 .

Or

- b) The 'T' section, details given below, is subjected to a shear force of 80KN at a section. Find the maximum shear stress in the section and show the variation of shear stress in the section. Thickness of web and flange - 2cm.

(15 marks)

4. a) A solid shaft 10cm diameter and 4m in length is subjected to twisting moment, which produces maximum shear stress of 60N/mm^2 . Determine the angle of twist in degrees. $N = 0.8 \times 10^6 \text{ N/mm}^2$. Derive the formula used.

Or

- b) Calculate the diameter of the shaft required to transmit 60H.P at 120r.p.m. If the maximum torque is likely to exceed the mean by 30%, for a maximum permissible shear stress of 55N/mm^2 . Calculate also the angle of twist for a length of 2m. $N = 0.8 \times 10^6 \text{ N/mm}^2$.

(15 marks)

5. a) A cantilever of span 4m carries two point loads 2KN and 4KN at the free end and mid span respectively. Using Macaulay's method, determine the maximum deflection.

Or

- b) A simple supported beam having span 6m carries two concentrated loads 20KN each at equal distance from mid point. Find the maximum deflection by Moment-area method.

(15 marks)

6. a) A mild steel tube 25mm internal diameter, 32mm external diameter, length 3m is used as a strut, one end fixed, other hinged. Calculate the collapsing load using E-2.1 $\times 10^5 \text{ N.mm}^2$

Or

- b) A cast iron column of hollow cylindrical section 5m long with ends firmly built-in, has to carry an axial load of 30tonnes. Determine the section using a factor of safety of 8. Internal diameter to be 8/10 of the external diameter. Rankine's constant for cast iron: $f_c = 567\text{N/mm}^2$, $\alpha = 1/1600$.

(15 marks)